
Desalination Options Assessment Report

Responsible Officer: Group Manager Planning and Delivery (Andrew Logan)

Recommendation:

That Council:

1. Receive and note the *Desalination Options Assessment Report (June 2024)* ([Attachment 1](#)).
2. Include Temporary Desalination as an option for consideration in an adaptive approach for the next revision of the Drought Management Plan.
3. Continue to focus planning efforts on preventative measures to reduce the impact of future droughts, through additional source augmentations.
4. Note the significant cost of a Permanent Desalination plant and poor comparison to previously costed groundwater and surface water alternatives.
5. Include Permanent Desalination, and the learnings from the Report, as an option for consideration in the next update to Rous's Integrated Water Cycle Management Strategy (IWCM).

Project Background

Desalination removes salts and other minerals from seawater to produce high-quality drinking water. A process called reverse osmosis is commonly used, where saltwater is pushed through a membrane that filters salt and mineral content.

The size of a desalination plant can range from a small unit the size of a shipping container, to large plants that can provide hundreds of millions of litres of drinking water a day.

Future Water Project 2060

The Future Water Project 2060¹ considered several potential Stage 3 water source options as part of its development. These sources include surface water, groundwater, desalination, water efficiency and Purified Recycled Water (PRW). Stage 3 options are considered as medium to longer term water sources with potential implementation between 2030 and 2060. The Future Water Project 2060 not only identified desalination as a potential longer term water source but also as an emergency source option as part of the Regional Water Supply Drought Management Plan.

The inclusion of Desalination as a Stage 3 option in the Future Water Project 2060 was derived from a previous investigation by Ganden Engineers in 2020² preliminary investigation by Ganden Engineers provided significant information, including a detailed comparison of the types of technologies that should be employed.

However, several data gaps and key risks remained, and the Integrated Water Cycle Management Strategy (IWCM) report suggested these should be resolved prior to any decision to proceed with the planning and approvals for a desalination option. These risks included location, electricity and water network integration, capital and operating cost, environmental approvals, marine park impacts, land acquisition, community engagement and detailed design.

¹ Rous Regional Supply: Future Water Project 2060 - Integrated Water Cycle Management Strategy – Hydrosphere Consulting - April 2022

² Rous County Council Desalination Investigation - Investigation Report Number: 1364-IR-001 2022, GanDen Engineers and Project Managers

Desalination Investigations – Scoping, Procurement and Timeline

Beca Hunter H2O was engaged through a supplier panel arrangement and awarded the contract to complete an options assessment into temporary desalination as a drought response, and also assess the role of permanent desalination. This investigation relates to both Rous's Drought Management Planning and IWCM.

The output from Beca Hunter H2O is a *Desalination Options Assessment Report* (the Report) (Attachment 1).

In the scoping of the options assessment, it was identified that temporary desalination plants have significant limitations and challenges. This led to consideration of permanent desalination as not only a possible longer term water source but also as a drought response option.

The concept of temporary desalination plants in the *Regional Water Supply Drought Management Plan 2016* (DMP) was heavily influenced by the 2014 Lower Hunter Water Plan. However, the temporary desalination approach was abandoned by Hunter Water in favour of a permanent drought response option in the updated Lower Hunter Water Security Plan 2022. A permanent drought response option is essentially where a permanent desalination plant is implemented in response to drought, with readiness actions and drought triggers documented in a drought management plan.

It is Rous's understanding that the temporary desalination approach was abandoned due to the complexity and cost of seeking approvals for multiple small desalination plants. Small desalination plants which exceed \$10 million individually, each require an environmental impact statement to progress approvals.

In addition, the experience of MidCoast Council in implementing the Nabiac Desalination plant (a temporary plant used as an emergency source) was not overly favourable. This is despite MidCoast Council having a favourable site for a temporary plant, at an existing groundwater treatment plant. The favourable aspects of the site included, having Council owned land adjacent to an estuary (i.e. short intake), with existing water and electrical network connections. However, the implementation of the temporary plant faced challenges during construction and the project was ultimately cancelled prior to implementation due to rain and the breaking of the drought.

The learnings for Rous were that permanent desalination could be considered as a permanent drought response and raised awareness of the potential challenges associated with the implementation of temporary desalination plants in a short timeframe.

As such the scope of the investigations was expanded to include consideration of permanent desalination plants as a potential drought response. This would also provide an opportunity to resolve some of the existing knowledge gaps about desalination as a potential water source.

The scope was discussed with numerous stakeholders including staff from the NSW Department of Climate Change, Energy, the Environment and Water (DCCEE, formerly DPIE/DPE).

Temporary Desalination

Temporary desalination was identified as one of several potential emergency source options as part of the DMP. The DMP detailed the following activation requirements for temporary desalination, with an expected timing of greater than 3 months:

- Determine suitable site/s
- Source package treatment plants
- Establish power supplies
- Determine brine disposal procedures.

The DMP also noted that:

“Further work is required to progress this option as a viable emergency source including site selection studies, approval requirements, technical and environmental investigations, and a review of procurement options. Ongoing research into potential improvements in desalination technology will be monitored on an on-going basis.”

Temporary desalination has also been identified in the Future Water Project 2060:

“Use of portable desalination units is one way of diversifying supply sources and reducing the risk of running out of water in an extreme drought. The units would be removed when no longer required.”

A review and update of the DMP was initiated in August 2021. Critical drought modelling³ was conducted as part of the Background Information and Recommended Plan Components⁴ undertaken as part of the DMP development. A review and scoping document was used to determine and inform the update of the DMP. The drought response modelling highlighted that Rous’s bulk water system can simultaneously have acceptable water security based on a 5/10/10 secure yield approach due to high and reliable rainfall, but that our system can be vulnerable to rapid dam depletion during severe and catastrophic droughts due to our modest storage volume. This modelling provides an assessment of how much time may be available for readiness and trigger actions in relation to emergency drought sources.

The Report provides an understanding of the requirements to implement desalination as a response to drought. For temporary desalination plants, the Report outlines that appropriate dam level triggers cannot be selected for low or moderate risk approaches (i.e. 60-70% Rocky Creek Dam level). The selection of dam level triggers based on a higher-risk approach (i.e. 50% Rocky Creek Dam level) does not provide enough time to guarantee that a temporary desalination plant would be operational when needed and with sufficient capacity to meet Level 5 emergency demand levels, particularly as the severity of droughts increases.

One of the difficulties associated with the selection of dam level triggers is that any Council decision to proceed with the implementation of a temporary desalination plant, would result in significant commitment of funds at that point (i.e. expected to be ~20% of the total project cost at trigger point and ~50% within 3 months of trigger point). This is because Rous would require suppliers to guarantee equipment and material deliveries within a certain timeframe. This would force contractors/suppliers to negotiate contract arrangements that recover their costs in the event of project cancellation.

Even at the proposed trigger level (i.e. 50% RCD Level), by far the most probable future outcome from this trigger (as indicated by internal modelling) is that the drought will break without the need to implement the temporary plant. Hence in the pathway proposed in the Report, Council would be asked to commit to significant expenditure with the understanding that an emergency response plant will not be necessary in more than 90% of instances.

The Report identifies a pathway by which costs can be deferred by adopting a just-in-time approach. The main cost item identified which would need to be committed to up-front and as a priority, is the seeking of approval (i.e. Environmental Impact Statement), which can take upwards of 24 months. Otherwise, the emergency supply option would be reliant on an ‘emergency’ approval for it to be implemented. Such an emergency approval would be at the discretion of the NSW Water Minister, without a guarantee that it would be forthcoming. Additionally, the emergency approval would not necessarily override all planning and implementation approval requirements.

Attempts to defer costs for the establishment of a temporary desalination plant in an emergency scenario come with a significant risk. Rous may be forced to enter a supply constrained market

³ Drought Response Modelling – **Engeny** - August 2023

⁴ Background Information and Recommended Plan Components: Interim Drought Arrangements and Longer-Term Drought Plan – **Hydrosphere Consulting** – October 2023

and consequently incur cost at rates higher than current market values. Scarcity might result from increased demand for containerised desalination systems, caused by widespread drought conditions across multiple regions and water utilities. This makes any business case for a temporary desalination plant difficult to evaluate.

However, it is reasonable to anticipate that in future severe droughts, the costs of containerised plants may be significantly higher than current conditions. Consequently, any attempt by Rous to defer costs, has an elevated risk of incurring higher costs at a potential future implementation point. In addition, as the inventory of temporary desalination plants is modest, there is no guarantee that any units will be available for Rous to procure, posing a significant inherent risk for the successful implementation of a temporary desalination plant.

The Report provides Rous with the key information needed to assess the utility of temporary desalination. Given the implementation of this project would coincide with severe or catastrophic droughts, it would be ideal if Rous can avoid the circumstances requiring its implementation. It is anticipated that the best way to avoid these kind of emergency responses, is to focus on ways to increase the region's baseline water security. Rous can, for instance, consider modelled drought scenarios as a sensitivity analysis when considering the timing and selection of future water source augmentations.

This does not mean that Rous should completely disregard temporary desalination as a potential emergency response, as it is a useful option of last resort. It could be used to provide small to moderate volumes of water to the community in an emergency, but its implementation would only mitigate the worst of circumstances (i.e. an ongoing supply below Level 5 during a day-zero scenario).

The learnings in the Report can be considered by Council in comparison to other potential drought response options (both permanent and emergency) and compared to augmentation of water supplies with new sources.

Desalination - Stage 3 Option of Future Water Project

The Report builds on previous desalination investigations, providing a more comprehensive approach to site selection and considers larger desalination plants which can service more than one of the coastal population centres (i.e. provide water to both Ballina and Byron).

The Report highlights that the site selection is significantly constrained by limitations resulting from the Cape Byron Marine Park. In particular, the Marine Park would significantly increase the cost, complexity and overall risk associated with marine intake and outtake infrastructure (i.e. the cost of intake and outtake structures are expected to be greater than \$20,000 per metre).

The Report has considered the objectives of the marine park zones in the Cape Byron Marine Park and the potential ecological and environmental impacts of desalination. To comply with the existing objectives of the marine park, it was determined that any intake and outtake structures would need to be in the general-purpose zones and could not be in the sanctuary or habitat protection zones. This approach did not consider other potential pathways, such as seeking the potential re-zoning of the Marine Park to accommodate intake and outtake structures. This meant that the length of intake and outtake structures would be significantly longer for most sites adjacent to the Marine Park. The increased length adds tens of millions of dollars onto the estimated project capital costs. Additionally, the deeper water depth at these locations may significantly complicate the installation and maintenance of intake and outtake structures, meaning that the typical use of divers would not be practicable, raising technical feasibility concerns.

The Marine Park extends from Brunswick Heads to Lennox Head. The upper edge (Brunswick Heads) is quite remote from the main population centres of Ballina and Byron, requiring extensive water transfer infrastructure, making these locations less viable. As a result, the site selection process concluded that beyond the northern extent of the Marine Park was not an appropriate site for a permanent desalination plant. This naturally leads to the preferred sites being identified

beyond the southern extent of the Marine Park. Whilst a preliminary site selection process has identified specific lots in Ballina Shire, there is a potential this would be further refined if additional investigations were undertaken.

In terms of cost, there has been a substantial change to the high-level cost estimates since Council's previous investigation in 2020. This is understood to be driven by changes in construction costs. Take for example the experience of Hunter Water with their planning for Belmont Desalination plant: cost estimates for the 30 ML/day plant escalated from ~\$200 million to ~\$530 million between 2020 and 2023. That project is equivalent to the concept considered in Rous's recent investigation, albeit at a larger capacity.

In summary, the Report provides Council with additional understanding of potential site locations for a full-scale permanent desalination plant. The Report identifies that costs are likely to be significantly higher than previously estimated, even when accounting for inflation. The costs of desalination as a potential Stage 3 option now appear to be significantly higher than the previously estimated costs on a capacity basis for the more conventional options of groundwater and surface water.

Subsequently, it is reasonable to expect that even moderate to poor conventional water source options (eg. saline groundwater) may be comparatively more cost-effective than the identified desalination schemes, reinforcing the previously indicated view in the Future Water Project 2060 that desalination is not an economically attractive option.

Governance

The *Desalination Options Assessment Report* (June 2024) will be an input into a future review of the Integrated Water Cycle Management Strategy (IWCM). The updated IWCM will be presented to Council for consideration at that time. As such, no specific actions are necessary at this stage.

- **Finance**

The *Desalination Options Assessment Report* received partial grant funding as part of the NSW Government's Safe and Secure Water Program. The project was completed within the approved budget amount.

Consultation

The project scope was developed in conjunction with NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW, formerly DPIE/DPE).

Site selection criteria were developed in conjunction with the consultant (BECA Hunter H2O), Council Staff, and representatives from NSW DCCEEW (formerly DPIE/DPE).

Conclusion – Temporary Desalination

The feasibility of temporary desalination has been investigated and, without the upfront construction of assets, there are inherent implementation risks which cannot be resolved in the available timeframes during a severe or catastrophic drought. Temporary desalination therefore is not a guaranteed way to maintain water supplies in a drought emergency.

Rous's small water storage means that there is not a large amount of time to implement reactive measures during a drought.

Additional planning for desalination as an emergency drought response measure is not likely to significantly alter Rous's overall vulnerability to drought, or significantly improve the risk profile of Rous's drought response in maintaining Level 5 emergency supplies when exposed to a severe or catastrophic drought.

Planning efforts should focus on preventative measures to reduce the impact of future droughts, as these measures can be implemented ahead of a drought (i.e. additional source augmentations), instead of reactionary measures, which have a higher risk profile. Preventative measures are more likely to mitigate Council's vulnerability to drought, thereby reducing the threshold severity of drought that may result in an emergency.

There is considered to be a limited role for temporary desalination in the later stages of drought. However, the potential implementation of temporary desalination should be considered in comparison to other potential drought response measures (both emergency and non-emergency). Rous's current Drought Management Plan allows for an adaptive approach, and it is suggested an adaptive rather than prescriptive approach is applied to temporary desalination. The Report provides information which can be used to make comparisons to other options and inform the adaptive approach adopted by Council when experiencing drought conditions.

Conclusion – Permanent Desalination

The feasibility of a permanent desalination plant has been investigated and the Report provides additional information about potential site locations, including constraints. The Report provides updated cost estimates for desalination which are significantly higher than previously estimated. At these cost estimate ranges, desalination does not compare favourably to previously costed groundwater and surface water alternatives. This reinforces the views previously indicated in the Future Water Project Error! Bookmark not defined., that desalination is not considered an attractive economic option when compared to conventional alternatives.

As part of the next update to Rous's Integrated Water Cycle Management Strategy (IWCM), a detailed comparison will be made, which will incorporate the learnings from the Report.

Attachment

1. *Desalination Options Assessment - Final Report – Beca HunterH₂O – June 2024*
<https://rous.nsw.gov.au/page.asp?f=RES-EQQ-20-04-75>